

Amendments to the Specification:

Please replace the as-published paragraphs [0006], [0007], [0009], [0011], [0021], [0033], [0037], and [0045] with the following rewritten paragraphs:

[0006] However, a problem with existing AUVs is that of "trim", i.e. buoyancy in water. Existing AUVs are designed to float with typically only a few kg (for example, 2 or 3 kg) of positive buoyancy, which reduces ~~manoeuvrability~~ maneuverability forces, resulting in a longer mission time. In addition, whenever an instrument is either attached to or removed from the AUV, it must be manually re-trimmed, which consumes valuable ship time. Furthermore, if the AUV is required to drop off or pick up an object during the mission then buoyancy is affected, which can result in either a rapid rise to the surface or, worse, drop to the seabed. Indeed, AUV buoyancy may be affected by mere changes in seawater density, to the extent that the AUV may not be able to surface, and thus be recovered.

[0007] In addition, a particular problem with AUV landers is the impact of the lander on the seabed. This impact can disturb the environment the lander is intended to record, which thus affords false readings. For example, the bow wave in front of a sinking lander can disperse superficial sediment on the surface of the seabed, which the lander may be intended to study, and the noise of the lander impact on the seabed may influence the ~~behaviour~~ behavior of animals intended to be studied.

[0009] The first type of buoyancy control system uses compressed air, which is conventionally used for buoyancy control on manned submarines. In these systems, buoyancy is decreased by filling ballast tanks with water, and buoyancy is increased by forcing the water from the tanks using compressed air. The disadvantages of compressed air systems are firstly that they require large amounts of power (hence their use on large, high-power manned submarines), and secondly that they are only operable to depths of hundreds of ~~metres~~ meters. The use of compressed air at greater depths becomes inefficient and dangerous, due to the very high air pressures required.

[0011] A problem that arises more frequently with AUVs is the drain on the electrical power supply. It is often a design aim for an AUV to make it small and relatively light. This aim is therefore not met if a larger power supply is required. Consequently, it is often necessary to make a compromise between the size (and weight) of the power supply and the size (and weight) of the AUV. The size of power supply that is selected can also place limits on the mission profile for the AUV. The compromise that is eventually made also has an

impact on the buoyancy control system that is used in the AUV. Thus, in any system used for buoyancy control difficulties arise in providing sufficient electrical energy to drive the various controls and other electrically operated components without, on the other hand, loading the vehicle with excessive battery weight and volume. These problems are particularly relevant when the AUV must descend into deep waters greater than 2000 ~~metres~~ meters for example.

[0021] FIG. 2 shows estimates of the energy required to generate buoyancy at 3000 ~~metres~~ meters depth using a ~~pre-pressurised~~ pre-pressurized air cylinder of differing volumes at 300 bar.

[0033] As the AUV descends into the sea, the control system 35 monitors the depth via the pressure transducer 36 and provides further negative buoyancy as required by letting more seawater into the sphere 5 by controlling solenoid valve 4. At some point the required depth is reached, for example 3000 ~~metres~~ meters. At this point, the local pressure LP is 300 bar. If the rate of descent is too rapid, then the solenoid valve 9 can be opened to allow gas into the flexible bag 7 to cause it to expand thereby producing positive buoyancy. Thus, a stable descent of the AUV can be achieved.

[0037] Thus, the pressure in the sphere 5 can be reduced allowing the flexible bag 7 to expand and create positive buoyancy. By using such a pressure multiplier 34, the electrical energy required to reduce the pressure in the sphere 5 is reduced. Moreover, by using cylinder 10 as a source of pressured gas, a pressure balancing can be achieved within the sphere wherein the amount of pumping work required to reduce the pressure of the seawater therein is reduced, which in turn reduces the amount of energy used by the electric motor 32. FIG. 2 illustrates estimates of the energy required to generate buoyancy at 3000 ~~metres~~ meters depth using a ~~pre-pressurised~~ pre-pressurized air cylinder of differing volumes at 300 bar. It will be appreciated that the pressure and volume of the cylinder 10 can therefore be selected to be most efficient at the particular depth at which the AUV will be working on its mission.

[0045] The present invention can thus provide a buoyancy control system which can enable a buoyancy change of 34 kg at 6000 ~~metres~~ meters with a low power consumption (24V battery, 150 W electric motor). Moreover, the system is relatively lightweight and compact, which in turn allows it to be used as a "bolt-on" to existing underwater submersibles.